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Atty Docket No. 7217/62364

TO THE ASSISTANT COMMISSIONER FOR PATENTS  
Washington, D.C. 20231

Sir:

With reference to the filing in the United States Patent and Trademark  
Office of an application for patent in the name(s) of:

Koichi Takeuchi  
Masami Himuro  
Ko Ishimoto  
Seisuke Ohba

entitled: LENS UNIT AND CAMERA

☐ Small entity status under 37 CFR 1.9(f) is  
claimed and the amounts shown in parentheses below have been  
employed.

The following are enclosed:

☒ Specification

☒ 19 Claims(s) (including 2 independent claim(s))

☐ Preliminary Amendment

☐ unsigned Oath or Declaration, Power of Attorney & Petition

☒ 9 Sheet(s) of Drawings

☒ Our check for \$690.00 calculated as follows:

Basic Fee of \$690 (\$345) .....\$ 690.00

☐ Total Claims in excess of 20 at \$18 (\$9).....\$ .00

☐ Ind. Claims in excess of 3 at \$78 (\$39).....\$ .00

☐ Fee of \$260 (\$130) for Mult. Dep. Claim.....\$ .00

Total Filing Fee .....\$ .690.00

Assignment Recording Fee of \$40 .....\$ .00

☒ Certified copy of each of the following to  
substantiate the claim for priority:

<u>Application No.</u>	<u>Filing Date</u>	<u>Country</u>
P11-234276	August 20, 2000	Japan

[illegible]

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application for Letters Patent

0031300 9224960

TITLE: LENS UNIT AND CAMERA

INVENTOR(S): KOICHI TAKEUCHI

MASAMI HIMURO

KO ISHIMOTO

SEISUKE OHBA

## LENS UNIT AND CAMERA

### BACKGROUND OF THE INVENTION

#### Field of the Invention

The present invention relates to a lens unit for use in camera and a camera preferably applied for a video camera, and more particularly to a lens unit preferably used for taking stereoscopic pictures and camera thereof.

#### Description of the Related Art

Recently, various camera structures have been proposed as the stereoscopic television camera.

In this stereoscopic cameras, there are two-camera type in which a picture for the right eye and a picture for the left eye are taken with two cameras and a single lens type in which pictures for the right eye and left eye are taken with a single camera.

In case of the two-camera type, a stereoscopic image is created by generating a parallax between pictures from the two cameras.

On the other hand, in case of the single lens stereoscopic system, a phenomenon that a parallax is generated in a large lens also is utilized.

Thus, in the single lens stereoscopic system, as shown in FIG. 16, an optical shutter 53 for shielding the divided right and left portions are provided in front of a lens 52 of

the camera 51. An optical path is divided to two sections by the optical shutter 53 and pictures are taken by switching over right and left optical paths by every vertical or horizontal operation.

In FIG. 16, only the right optical path is indicated in the right half. Then, the left optical path is indicated in the left half with solid line while the right optical is indicated with dot line in order to compare.

With this structure, an image for the right eye for a stereoscopic picture is taken by opening a right eye shutter 53R and an image for the left eye is taken by opening a left eye shutter 53L.

In FIG. 16, a focal point is placed on an object 55 in an intermediate distance (for example, man) so that the object 55 is in focus on an image pickup plane 57.

At this time, an object (for example, mountain) 54 farther from the focal point 55 is in focus in front of the image pickup plane 57 so that a blurred image is formed on the image pickup plane 57 and represented on an opposite side to the shutter through which the corresponding light passes, that is, the left eye image is formed to the right relative to the center while the right eye image is formed to the left relative to the center.

An object (for example, flower) 56 nearer the focal point is in focus behind the image pickup plane 57 so that a

blurred image is formed on the image pickup plane 57. Then, that object is represented on the same side as the shutter through which the corresponding light passes, that is, the left eye image is formed to the left relative to the center while the right eye image is formed to the right relative to the center.

Consequently, the left eye image 58L and the right eye image 58R formed on the image pickup plane 57 are represented at deviated positions to the right and left corresponding to a distance to the object even if it is located just in front.

By using this phenomenon as parallax information and then watching two images in combination therewith, a stereoscopic image can be produced depending on a distance up to the object.

However, the above described stereoscopic television camera based on the single-lens stereoscopic system cannot be applied to a system having zooming function by a zoom lens sufficiently.

If the above described shutter for switching the right and left images is disposed in front of lenses including the zoom lens, although there is no problem on the telescopic side of the zoom, vignetting or shading, in which the right or left edge is chipped (becomes invisible) may be sometimes generated on each of the right and left screens L, R as shown in a diagonal line of FIG. 17.

If such a vignetting is generated, use of the zoom lens

is limited, for example, the zoom range has to be narrowed.

Thus, it is difficult to apply the zoom function to the stereoscopic camera.

#### SUMMARY OF THE INVENTION

To solve the above described problem, the present invention intends to provide a lens unit and camera capable of achieving both the stereoscopic television function and the zoom function at the same time.

To achieve the above described object, according to an aspect of the present invention, there is provided a lens unit comprising: at least a lens including a zoom lens; a light quantity adjusting means; an electronic optical shutter provided on a subsequent stage of the zoom lens; and an optical shutter driving portion for controlling the electronic optical shutter to an opening of a predetermined pattern.

Further, according to another aspect of the present invention, there is provided a camera comprising: at least a lens including a zoom lens; a light quantity adjusting means; an electronic optical shutter provided on a subsequent stage of the zoom lens; and an optical shutter driving portion for controlling the electronic optical shutter to an opening of a predetermined pattern.

According to the structure of the present invention, because the electronic optical shutter is provided on a subsequent stage of the zoom lens, a screen edge is never







FIGS. 15 are diagrams showing how a picture is seen when the deviation between right and left pictures is changed;

FIGS. 15A is a diagram showing a case in which the focused position is near the camera;

FIG. 15B is a diagram showing a case in which the focused position is far from the camera;

FIG. 16 is a diagram showing a stereoscopic camera optical system of a conventional single-lens stereoscopic type; and

FIG. 17 is a diagram showing a phenomenon that ends of a screen in the stereoscopic camera of FIG. 16 are missed.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention concerns a lens unit comprising at least a lens including a zoom lens, a light quantity adjusting means, an electronic optical shutter provided on a subsequent stage of the zoom lens, and an optical shutter driving portion for controlling the electronic optical shutter to an opening of a predetermined pattern.

Further, the lens unit of the present invention includes a diaphragm for changing the size of an opening mechanically by means of the light quantity adjusting means.

Still further, the lens unit of the present invention includes a filter as the light quantity adjusting means.

In the lens unit of the present invention, the electronic optical shutter is disposed in the vicinity of the

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the present invention.

This stereoscopic camera 1 is comprised largely of a lens unit 2 containing a large number of lenses and a camera main body 3 including the solid image pickup device 8.

The lens unit 2 is comprised of a zoom lens 4 having magnification changing function (zoom function), a first lens group 5 and a second lens group 7.

According to this embodiment, a liquid shutter 6 is disposed as an electronic shutter between the first lens group 5 and the second lens group 7 in the lens unit 2.

This liquid shutter 6 is divided to two sections 6A and 6B corresponding to right and left images across the center of the light path. A predetermined operation, for example, opening and closing of the two sections 6A and 6B alternately is carried out by a liquid driving portion (not shown).

That is, according to this embodiment, the optical shutter (53 in FIG. 16), which switches over right and left images in the conventional single-lens stereoscopic type camera, is transferred to between the first lens group 5 and the second lens group 7, namely, near a position where an ordinary diaphragm mechanism exists.

Then, like a structure shown in FIG. 16, the light path of the lens is divided to two sections, right and left, so that an image for the right eye of a stereoscopic picture is taken by opening a shutter 6A for the right eye image and an image for

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According to this embodiment, no ordinary diaphragm mechanism is provided, and instead, the liquid shutter 6 functions as the light quantity adjusting means at the same time.

Particularly if the liquid shutter 6 is constructed of fine matrix-like pixels 11 as shown in FIG. 2 and each pixel is driven separately, a desired opening pattern can be formed. Thus, the size of the opening pattern can be changed easily so as to adjust the incident light quantity.

Therefore, for example, the two opening patterns can possess an overlapping portion. Particularly, if the liquid shutter 6 is constituted of such fine matrix-like pixels 11 as shown in FIG. 2, an opening pattern having the overlapping portion can be obtained easily.





telescopic photography is intensified. Conversely, such a pattern, which facilitates to secure the parallax, is employed as a degree of the wide angle photography whose focal distance is short is intensified.

FIG. 5 shows a case in which actually the light quantity adjusting means is actuated by the liquid shutter 6.

In FIG. 5, two opening patterns 13A, 13B are variable in size so that the incident light quantity is also variable.

FIG. 5A indicates a full opening condition. The opening patterns 13A, 13B are semi-circles which are obtained by dividing the same circle as FIG. 3A to two sections. FIG. 5B indicates a state in which the incident light quantity is squeezed a little. There is a closed portion 13X between the two opening patterns 13A and 13B, which does not allow light to pass through.

FIG. 5C indicates a state in which the incident light quantity is squeezed to some extent. The closed portion 13X occupies largely so that small opening patterns 13A, 13B exist on the right and left ends.

By changing the sizes of the opening patterns 13A, 13B as described above, the incident light quantity can be changed.

Preferably, it is so constructed to provide the camera with an exposure meter or the like so that the size of the opening pattern of the liquid shutter 6 is changed automatically or manually corresponding to a measured value to adjust the

incident light quantity.

In the meantime, it is permissible to change three opening patterns shown in FIGS. 5A-5C gradually or it is also permissible to change the size of the opening pattern including middle opening patterns of these continuously.

By using the liquid shutter 6, the liquid shutter can be driven easily so as to change the size continuously.

FIG. 6 shows other example of the operation of the light quantity adjusting means by the liquid shutter 6.

According to the example shown in FIG. 5, the right and left opening patterns 13A, 13B are departed from each other successively with an increased distance therebetween as the opening is squeezed. According to the example shown in FIG. 6, each gravity center of the opening pattern is substantially maintained.

FIG. 6A shows a case of a large opening. Right and left opening patterns 14A, 14B are large opening patterns near semi-circle. There is a closed portion 14X between the two opening patterns 14A and 14B, which does not allow light to pass through. FIG. 6B indicates a case of a small opening. Gravity center positions of the right and left opening patterns 14A, 14B are substantially the same as FIG. 6A.

In this case also, an intermediate condition between FIG. 6A and 6B is possible and the size of the opening can be changed continuously.



FIG. 8. Then, the light quantity adjusting means 20 and the liquid shutter 6 are disposed between the first lens group 5 and the second lens group 7 shown in FIG. 1, that is, at a position where an ordinary diaphragm mechanism should be disposed.

Then, the incident light quantity to the liquid shutter 6 is regulated by an opening 20a provided on the light quantity adjusting means 20.

Next, an embodiment of a structure incorporating this mechanical diaphragm will be described below. As shown in FIG. 9, four blade-like shield plates 21a-21d are mounted in the vicinity of the liquid shutter 6 (6A, 6B) such that an end of each thereof is fixed by a pin 22 so as to construct a light quantity adjusting means. By rotating the shield plates 21a-21d around the fixed end (pin) 22, the size of the opening is changed so as to change the quantity of light passing through.

FIG. 9A indicates a full opening condition, in which the shield plates 21a-21d are located out of the liquid shutter 6.

FIG. 9B indicates a little closing condition, in which part of the shield plates 21a-21d shields the liquid shutter 6. FIG. 9C indicates that the shield plates are further closed and front ends of the four shield plates 21a-21d overlap each other in the center so that about 1/3 of the liquid shutters 6A, 6B are hidden.

FIG. 9D indicates that the shield plates are closed most and the four shield plates 21a-21d overlap each other most so

that most part of the liquid shutters 6A, 6B are hidden.

By incorporating the solid image pickup device 8 in the camera 1 shown in FIG. 1, the shutter can be operated by a driving of the solid image pickup device 8. Therefore, the mechanical diaphragm does not always have to be closed fully unlike the film type camera.

Further, because the camera mentioned in the present invention is used mainly as a video camera, its picture-taking operation can be turned on/off with a switch, button or the like. Therefore, it is possible to produce a state having no incident light quantity even if the mechanical diaphragm is not closed fully.

Next, other embodiment of the mechanical diaphragm will be described below.

In this mechanical diaphragm, openings are formed in a rotary or slidable part and then by moving this part, the openings are variable.

In FIG. 10, three openings 23a, 23b, 23c are formed in the rotary disc-shaped part 23 and by rotating this part 23 around an axis thereof, the three openings 23a, 23b, 23c are switched over.

According to the opening pattern of the liquid shutter 6 in this case, two opening patterns 6A, 6B produced by cutting a circle with respect to the center thereof as indicated by dotted line are indicated alternately. A first opening 23a is

substantially fully open and this opening is relatively smaller than the liquid shutter 6 (6A, 6B).

In a second opening 23b, about 1/3 of the liquid shutter 6 is hidden.

A third opening 23c is a smaller opening than the second opening 23b.

FIG. 11 shows an embodiment in which an opening is formed in a slidable part 24. In FIG. 11A, three openings 24a, 24b, 24c each having the same shape as FIG. 10 is formed in the slidable part 24. By sliding this part in an arrow direction, the three openings 24a, 24b, 24c are switched over.

In FIG. 11B, an opening 25d having the same shape as the second opening 23b of FIG. 10 is formed and then, by sliding this part 25 in an arrow direction, either a condition in which about 1/3 of the liquid shutter 6 is hidden by this opening 25d or a fully open state in which the part 25 is removed from before the liquid shutter 6 is selected.

Next, an embodiment in which the filter is used as the light quantity adjusting means will be described below.

FIG. 12 schematically shows a case in which the filter 26, for example, the ND filter is provided just in front of the liquid shutter 6. Light passing through the filter 26 enters the respective parts 6A, 6B of the liquid shutter 6.

By attaching or removing the filter 26 or replacing with another filter having a different transmittance, the light

quantity can be changed.

FIG. 13 schematically shows a case in which the polarizing filter, for example, the polarizing ND filter is employed. Two polarizing filters 27, 28 each having a polarizing direction as indicated by an arrow are used such that they overlap each other. In this case, by adjusting an angle  $\theta$  produced by the polarizing directions of the two polarizing filters 27, 28, for example, by rotating at least one of the polarizing filters, the incident light quantity can be changed.

Because ordinarily, the polarizing plate is provided on the liquid shutter 6, it is permissible to so construct that one of the two polarizing filters 27, 28 of FIG. 13 is used as the polarizing plate of the liquid shutter 6.

In the meantime, the filter 26 and polarizing filters 27, 28 do not always have to be disposed near the liquid shutter 6 unlike the mechanical diaphragm and instead, may be disposed before or after the zoom lens 4. At least in the construction shown in FIG. 1, the filter may be incorporated within an optical system in front of the solid image pickup device 8.

Next, an embodiment in which an electronic shutter composed of the solid image pickup device 8 is employed as a light quantity adjusting means will be described below.

If for example, a CCD solid image pickup device is employed as the solid image pickup device 8, unnecessary charge can be discharged to a substrate or a vertical CCD register by

operating the electronic shutter so as to reduce accumulation time of a signal charge thereby making it possible to accelerate shutter speed.

If this is applied, the signal charge to be accumulated can be reduced by shortening the accumulation time, so that the same effect as when the incident light quantity is reduced by an ordinary light quantity adjusting means is produced.

Other solid image pickup device, for example, MOS type solid image pickup device, is capable of securing the same effect by achieving the electronic shutter operation in the same manner.

Particularly if the liquid shutter 6 composed of the matrix-like pixels 11 is used, a finer degree of the diaphragm can be changed continuously as shown in FIG. 2.



continuously by rotating the four blade-like shield plates 21a-21d.

Further, if the filter is employed as the light quantity adjusting means, with the configuration shown in FIG. 13, the incident light quantity can be changed continuously and smoothly by rotating the two polarizing filters 27, 28 to change the angle  $\theta$  produced by the polarizing directions. If the electronic shutter by the solid image pickup device 8 is employed as the light quantity adjusting means, the time interval of the pulse for the operation of the electronic shutter may be changed and therefore, the incident light quantity can be changed relatively easily.

Because according to this embodiment, the liquid shutter 6 is disposed on a subsequent stage to the zoom lens 4, occurrence of vignetting on the side of a wide angle of the zoom lens 4 can be suppressed.

Therefore, the zoom lens 4 can be used in entire zoom rate region from a wide angle side to a super telescopic side, like an ordinary camera, and thus, a stereoscopic photography can be carried out by the same handling for the ordinary camera.

Further, because single-lens stereoscopic system is employed, the parallax is not so large that a picture which does not tire the eyes can be obtained. An image which attracts an attention so that it is desired to be indicated is focused sharply, while places nearer or farther than that place is

blurred to an appropriate extent, so that a person's viewpoint is fixed thereby making the eyes less tired.

If the opening pattern is changed so that the distance thereof becomes shorter on the telescopic side as shown in FIG. 4, an increase of the parallax on the telescopic side is prevented, so that an image which does not tires the eyes can be produced.

It is permissible to provide a portion corresponding to the second lens group 7 located at a subsequent stage of the liquid shutter 6 with a variable power lens system so as to carry out magnification conversion between the zoom lens 4 and the solid image pickup device 8.

Further, this variable power lens system may be so constructed to be detachable from the lens unit 2 for replacement and may be attached or detached depending on the specification of the camera 1 on which this lens unit is to be mounted or an object to be photographed.

If the variable power lens system is provided, it is possible to use a lens having a large aperture for the zoom lens 4 and an image pickup device having a small size for the solid image pickup device 8. Thus, the size of the camera main body 3 and power consumption of the solid image pickup device 8 can be reduced.

In the meantime, the driving circuit for the liquid shutter 6 may be mounted on the lens unit 2 or the camera main



In this case, it is permissible to use the same speed (double speed) for storage into a memory or display of pictures. Alternatively, it is also permissible to convert to a single time speed and record with a VTR adapted for two screens.

3) A progressive camera is used for taking pictures.

This progressive camera scans all lines successively and therefore is different from an ordinary field scanning in which odd lines are scanned to obtain odd fields and after that, even lines are scanned to obtain even fields.

Then, the left image and right image are switched over every 1/60 seconds.

Reproduction is carried out at the same speed.

4) Upon taking pictures, a so-called high-vision specified (1125 lines) camera is used. A field is scanned in 1/60 seconds such that half of 1125 lines is scanned. The left and right images are switched over corresponding to each field.

For reproduction, the same high vision specified reproduction unit (VTR or the like) is used.

5) In this case also, the so-called high vision specified camera is used for taking pictures.

Thus, like 4), a field is scanned in 1/60 seconds such that half of 1125 lines is scanned. At the same time, the left image and right image are switched over corresponding to each field.

In this case, two ordinary NTSC specified (525 lines)





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By displaying (reproducing) the right and left images by deviating relative to each other, it is inhibited to display a distant view on a deeper side or display an object nearer the camera than a focal point such that it is projected unnaturally from a screen, so that the obtained image can be a natural stereoscopy.

More specifically, if the focal point is near the camera, the deviation amount  $\Delta$  is a small value  $\Delta_1$  as shown in FIG. 14A.

28

Consequently, an actually seen image is as shown in FIG.

15.

If the focal point is placed on a distance near the camera, a distance between the left image 42L and the right image 42R is short as shown in FIG. 15A, so that an image 42 from a left eye viewpoint 41L and a right eye viewpoint 41R is seen at a position with a short distance  $d_1$  from the screen 40. If the focal point is placed on a distance far from the camera, the distance between the left image 43L and the right image 43R is short as shown in FIG. 15B, so that an image 43 from the left eye viewpoint 41L as same as FIG. 15A and the right eye viewpoint 41R is seen at a position with a long distance  $d_2$  from the screen 40.

Thus, that distance changes corresponding to the focal point and a distance from the camera when the right and left image are seen.

Further, an object nearer the focal point is not seen such that it is unnaturally projected from the screen 40, so that it is seen as a stereoscopic image having a natural depth form a viewer.

Methods for deviating display positions of the right and left images with respect to each other include a mechanical method for, for example, deviating optical paths of two display units, an electric method for deviating signals of the right and left images electrically by, for example, delaying a horizontal









Then, the driving frequency can be increased to more than 10 kHz, which is higher than the liquid shutter, so that a high speed switching operation is enabled.

Therefore, a shutter operation for switching over the right and left images for each line is enabled. Although the shutter operation for each line cannot be combined under a current CCD solid image pickup device, this is also made possible if the configuration of the image pickup device is changed.

According to the present invention, the switch of the right and left images by the electronic optical shutter may be carried out for each field, each frame or each line.

If the liquid shutter 6 is used as the electronic optical shutter, the above described switch for each field is more preferable because of the driving frequency of the liquid crystal. If PLZT or the like is employed as the electronic optical shutter, the above described switch for each line is possible.

Although according to the above described embodiment, the liquid shutter 6 which is an electronic optical shutter is disposed at the position where the ordinary diaphragm mechanism is provided, the electronic optical shutter of the present invention is not restricted to the position where the ordinary diaphragm mechanism should be disposed.

The electronic optical shutter may be disposed at any



matrix-shaped pattern as shown in FIG. 2, there is such an advantage that any opening pattern can be formed.

The present invention is not restricted to the above described respective embodiments however, it may be modified in various ways within a scope not departing from the gist of the invention.

According to the present invention, a chipping of an image on the wide angle side of the zoom lens can be suppressed by providing with the electronic optical shutter on a subsequent stage of the zoom lens.

Therefore, it comes that the zoom lens can be used in entire zoom rate region from the wide angle side to the super telescopic side, so that a stereoscopic image can be taken in the same procedure as for an ordinary camera.

Further, because according to the present invention, the single-lens stereoscopic system is employed, the parallax is not so large, so that images which do not tire the eyes can be obtained.

Particularly if it is so constructed that the opening pattern is changed corresponding to the zoom condition of the zoom lens, increase of the parallax on the telescopic side can be suppressed.

Having described preferred embodiments of the invention with reference to the accompanying drawings, it is to be understood that the invention is not limited to those precise embodiments and that various changes and modifications could be effected therein by one skilled in the art without departing from the spirit or scope of the invention as defined in the appended claims.

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What is claimed is:

1. A lens unit comprising:  
at least a lens including a zoom lens;  
a light quantity adjusting means;  
an electronic optical shutter provided on a subsequent stage of said zoom lens; and  
an optical shutter driving portion for controlling said electronic optical shutter to an opening of a predetermined pattern.
2. The lens unit according to claim 1 wherein said light quantity adjusting means is a diaphragm for changing the size of an opening mechanically.
3. The lens unit according to claim 1 wherein said light quantity adjusting means is a filter.
4. The lens unit according to claim 1 wherein said electronic optical shutter is disposed near said light quantity adjusting means.
5. The lens unit according to claim 1 wherein said electronic optical shutter is composed of a liquid shutter.



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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

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adjusting means at the same time.

18. The camera according to claim 17 wherein said electronic optical shutter is composed of a liquid shutter.

19. The camera according to claim 10 wherein said light quantity adjusting means is an electronic shutter constituted of a solid image pickup device.

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FIG. 1

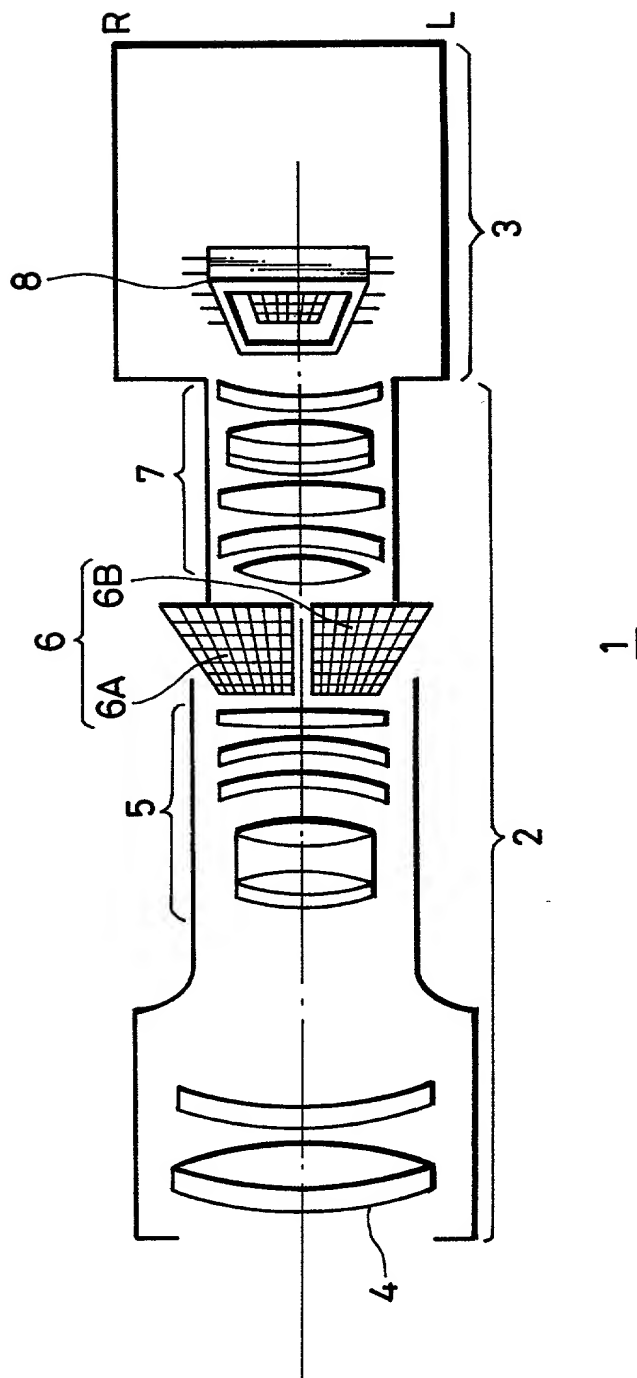


FIG. 2

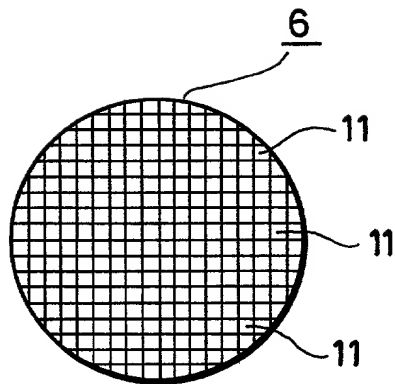


FIG. 3

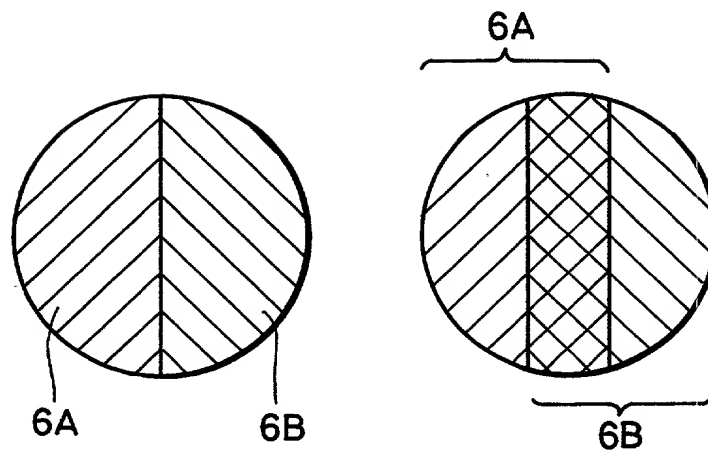


FIG. 4A

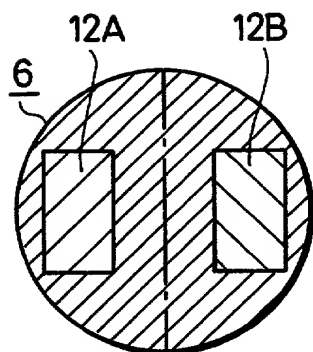


FIG. 4B

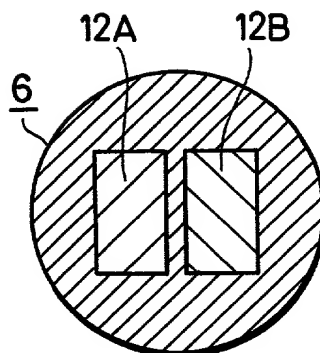


FIG. 4C

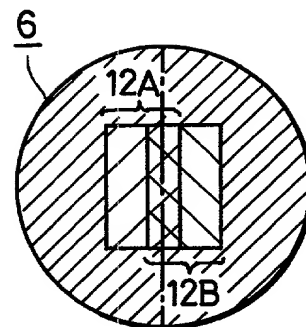


FIG. 5A

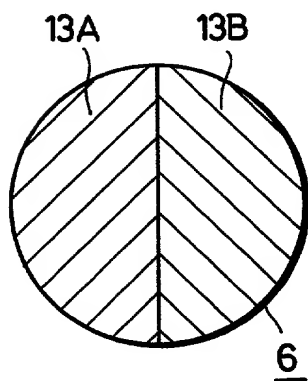


FIG. 5B

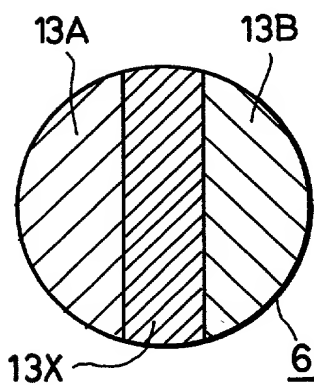


FIG. 5C

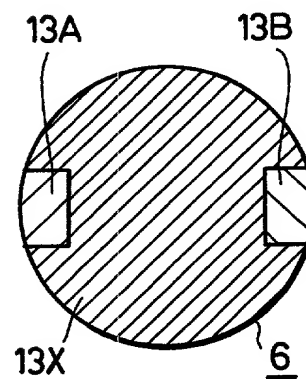


FIG. 6A

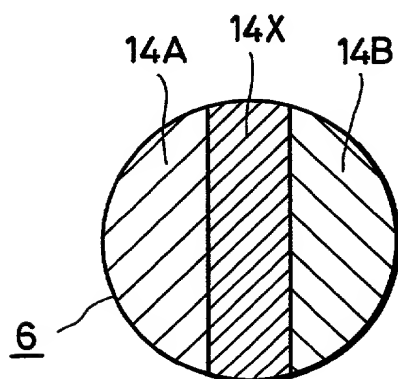


FIG. 6B

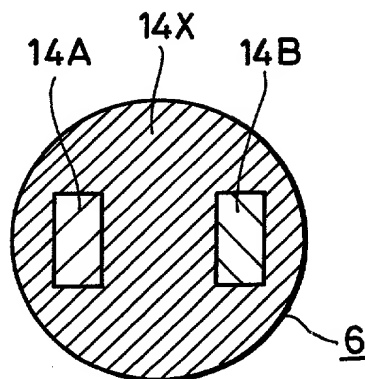


FIG. 7

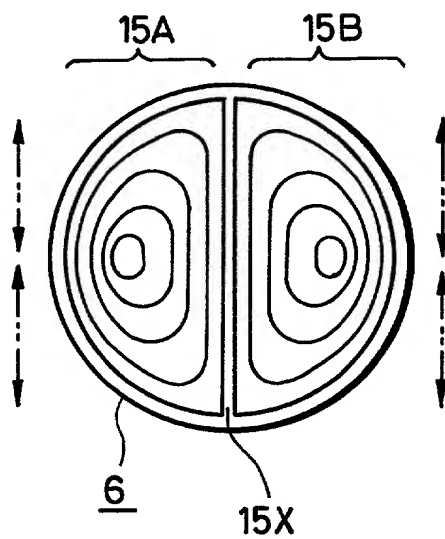


FIG. 8

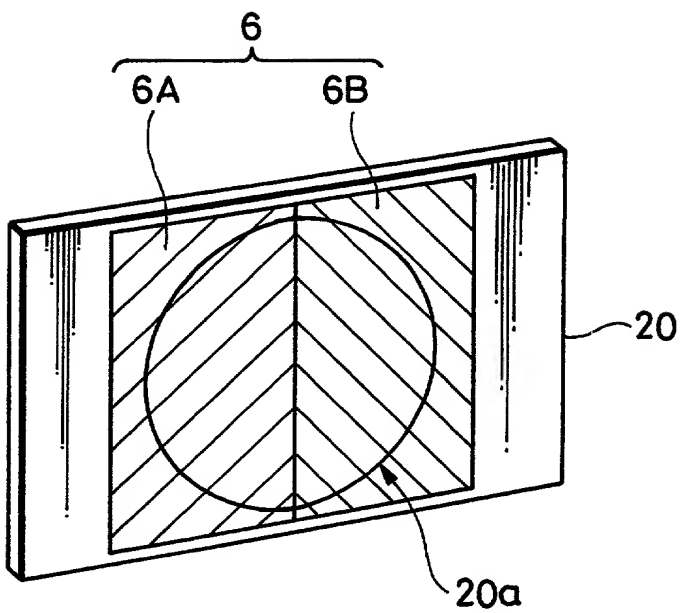




FIG. 9A

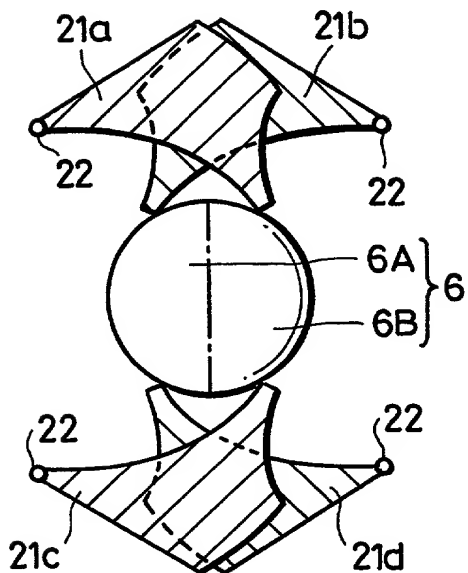


FIG. 9B

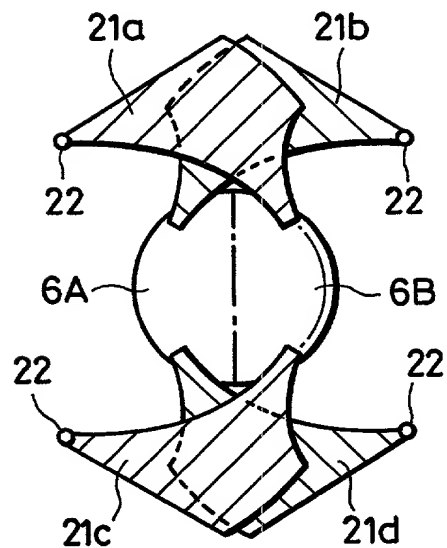


FIG. 9C

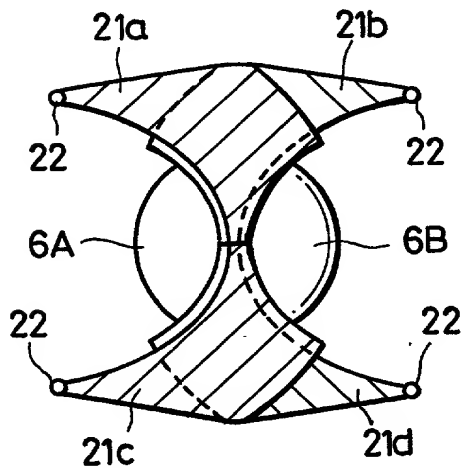


FIG. 9D

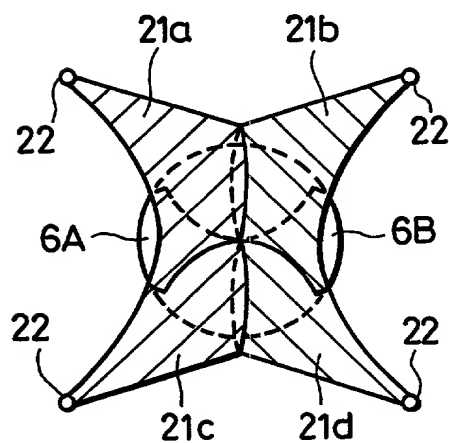


FIG. 10

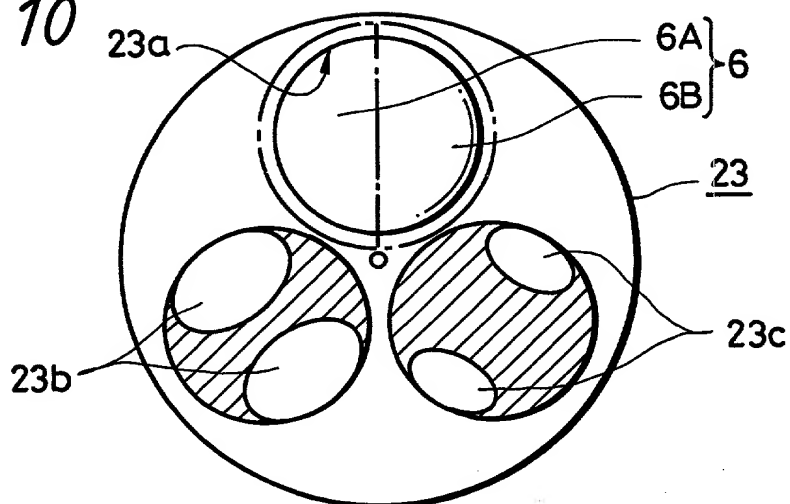


FIG. 11

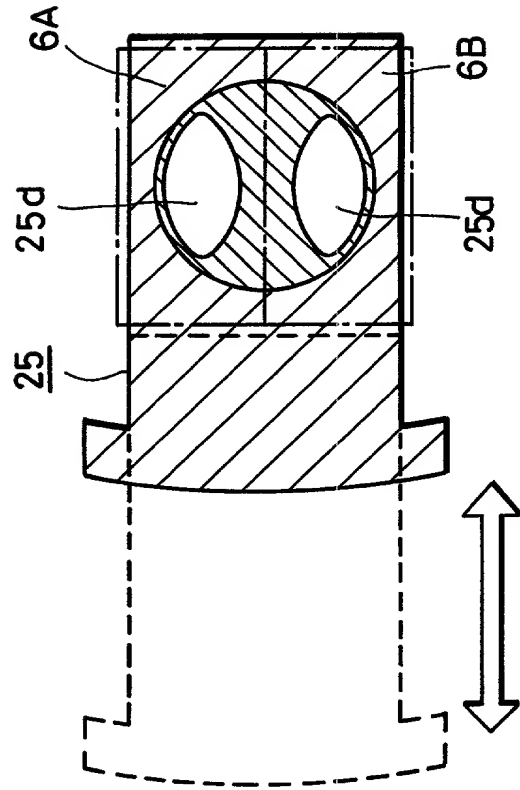
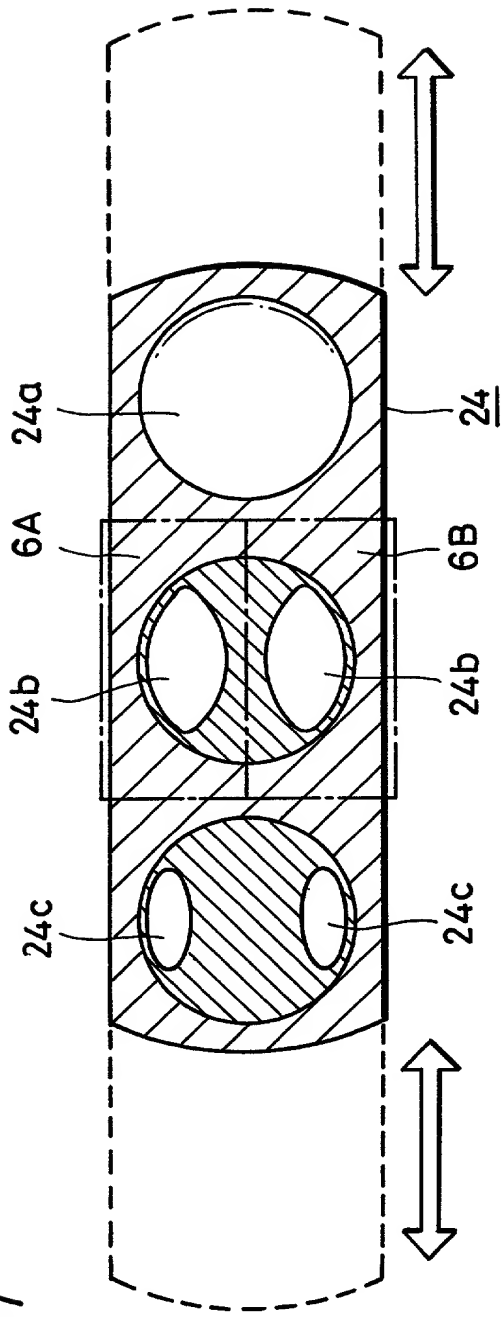


FIG. 12

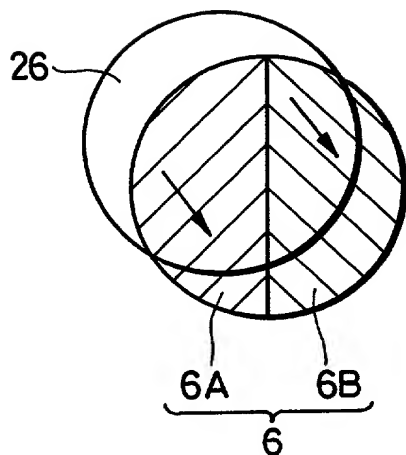


FIG. 13

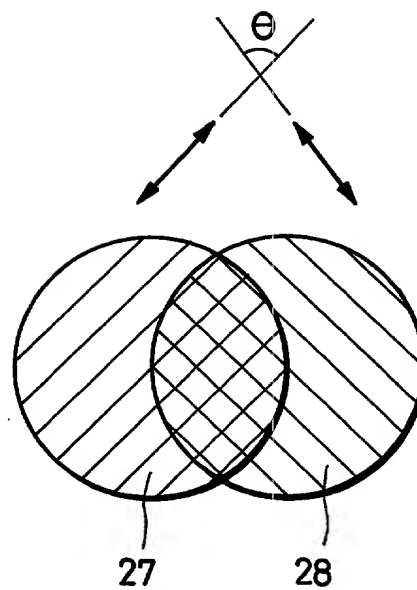


FIG. 14A

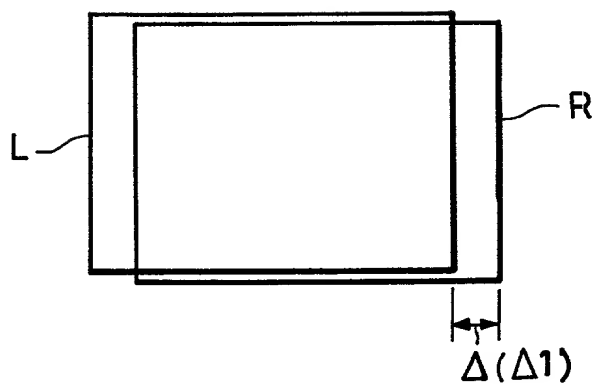
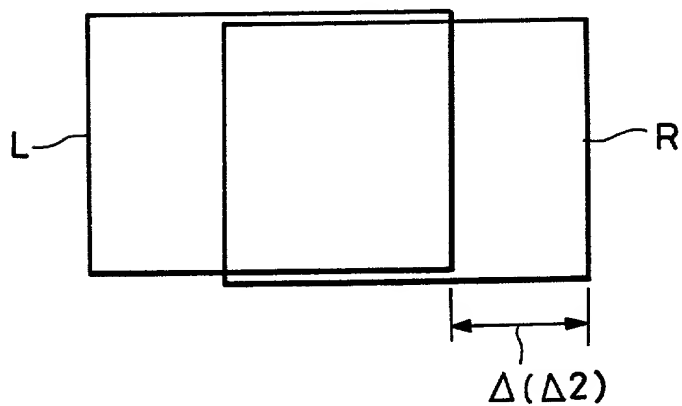


FIG. 14B



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FIG. 15A

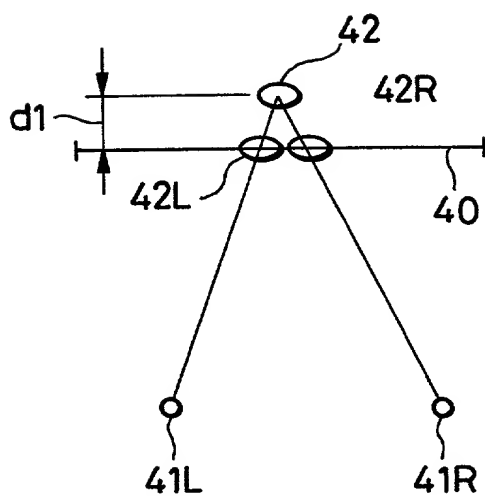


FIG. 15B

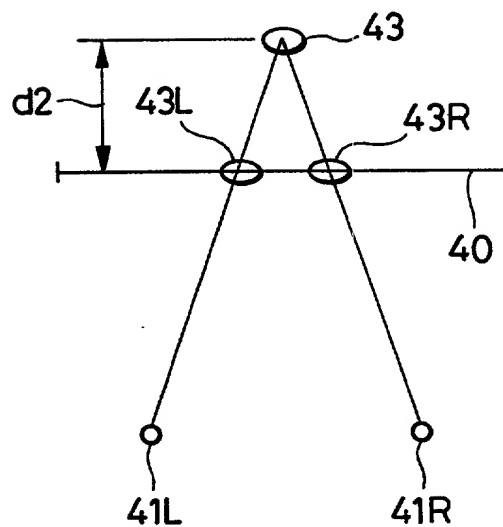


FIG. 17

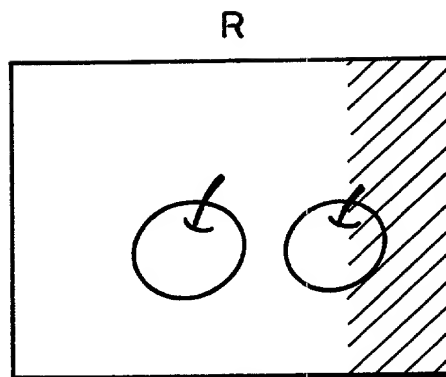
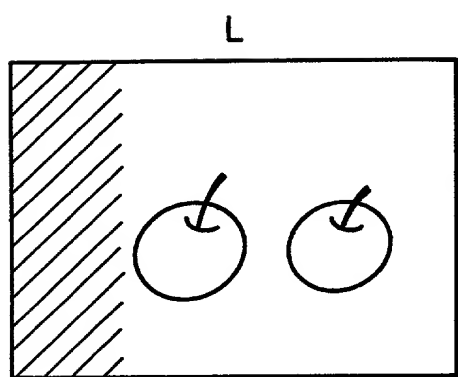
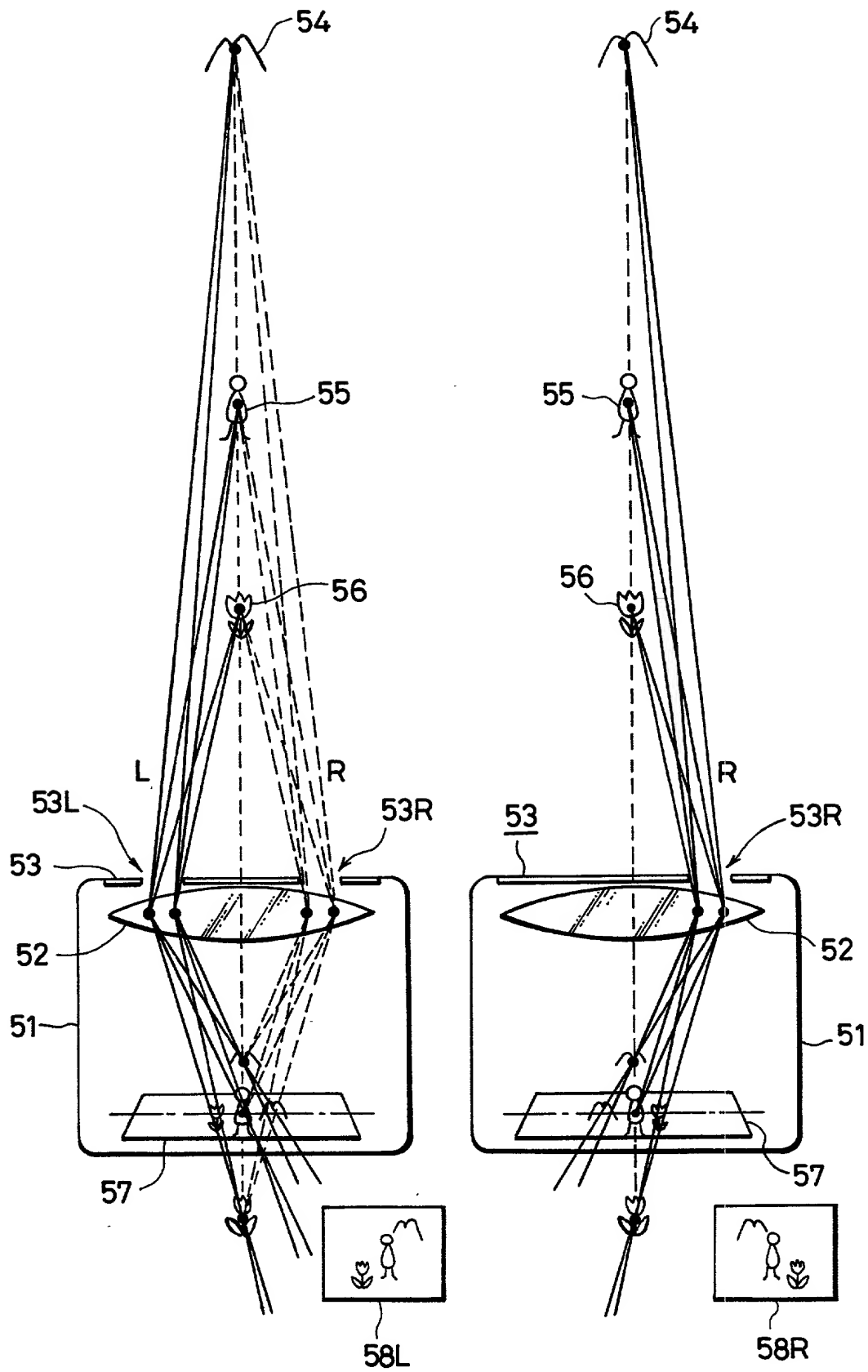


FIG. 16



# SECRET

**As a below-named inventor, I hereby declare that:**

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**the specification of which  
(check one)**

\_\_\_\_\_ was filed on \_\_\_\_\_ as \_\_\_\_\_

and was amended on \_\_\_\_\_ (if applicable)

**I acknowledge the duty to disclose information of which I am aware which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).**

**Prior Foreign Application(s)**

**Priority Claimed**

<u>Number</u>	<u>Country</u>	<u>Filing Date</u>	<u>Yes</u>	<u>No</u>
<u>PI1-234276</u>	<u>Japan</u>	<u>August 20, 1999</u>	<u>X</u>	<u></u>

Declaration and Power of Attorney

Page 2

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States Application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

<u>Application Serial No.</u>	<u>Filing Date</u>	<u>Status</u>
_____	_____	_____
_____	_____	_____

And I hereby appoint Jay H. Maioli, Reg. No. 27,213; Donald S. Dowden, Reg. No. 20,701; William F. Pelton, Reg. No. 25,702; Peter J. Phillips, Reg. No. 29,691; Gerald W. Griffin, Reg. No. 18,886; Ivan S. Kavrukov, Reg. No. 25,161; Christopher C. Dunham, Reg. No. 22,031; Norman H. Zivin, Reg. No. 25,385; John P. White, Reg. No. 28,678; and Robert D. Katz, Reg. No. 30,141; and each and all of them, all c/o Cooper & Dunham, 1185 Avenue of the Americas, New York, NY 10036 (Tel. (212) 278-0400), my attorneys, each with full power of substitution and revocation, to receive the patent, to transact all business in the Patent and Trademark Office connected therewith and to file any International Applications which are based thereon under the provisions of the Patent Cooperation Treaty.

Please address all communications, and direct all telephone calls, regarding this application to

JAY H. MAIOLI  
Cooper & Dunham LLP  
1185 Avenue of the Americas  
New York, New York 10036  
Tel. (212) 278-0400

Reg. No. 27,213

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or  
First joint inventor Koichi Takenchi  
Inventor's signature \_\_\_\_\_  
Citizenship Japanese Date of Signature \_\_\_\_\_  
Residence Kanagawa, Japan

[illegible]

Post Office Address c/o Sony Corporation, 7-35 Kitashinagawa, 6-chome  
Shinagawa-ku, Tokyo 141, Japan



[illegible]

**As a below-named inventor, I hereby declare that:**

**I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:**

**the specification of which  
(check one)**

\_\_\_\_\_ was filed on \_\_\_\_\_ as \_\_\_\_\_

Application Serial No. \_\_\_\_\_

and was amended on \_\_\_\_\_ (if applicable)

**I acknowledge the duty to disclose information of which I am aware which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).**

**Prior Foreign Application(s)**

**Priority Claimed**

<u>Number</u>	<u>Country</u>	<u>Filing Date</u>	<u>Yes</u>	<u>No</u>
<u>P11-234276</u>	<u>Japan</u>	<u>August 20, 1999</u>	<u>X</u>	<u></u>

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Page 2

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<u>Application Serial No.</u>	<u>Filing Date</u>	<u>Status</u>
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Please address all communications, and direct all telephone calls, regarding this application to

**JAY H. MAIOLI**  
Cooper & Dunham LLP  
1185 Avenue of the Americas  
New York, New York 10036  
Tel. (212) 278-0400

Reg. No. 27,213

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or  
First joint inventor Koichi Takenuchi

Inventor's signature \_\_\_\_\_

Citizenship Japanese Date of Signature \_\_\_\_\_

Residence Kanagawa, Japan

[illegible]

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Shinagawa-ku, Tokyo 141, Japan